

In the Claims

1. --49 (cancelled)

50. (amended) A system for treating or diagnosing the intestinal tract comprising:
an autonomous capsule comprising an acoustic transducer, the transducer being
arranged to emit an acoustic signal detectable externally of a patient's body as the capsule
passes through at least a portion of the intestinal tract; and
at least one external acoustic receiver configured to sense the acoustic signal
transmitted by the capsule; and
a reference generator arranged to generate a time reference from which the time
of the acoustic signal generation is determined.

51. (original) The system of claim 50 wherein the system comprises a plurality of
external acoustic receivers configured to sense the acoustic signal transmitted by the
capsule.

52. (cancelled).

53. (amended) The system of claim 52 50 wherein the reference signal is a trigger signal
arranged to trigger generation of the acoustic signal.

54. (original) The system of claim 50 wherein the capsule comprises a plurality of
acoustic transducers, each of the plurality of transducer being arranged to emit an
acoustic signal detectable by the at least one acoustic receiver as the capsule passes
through at least a portion of the intestinal tract, to provide information from which the
orientation of the capsule may be derived.

55. (original) The system of claim 50 wherein the at least one external acoustic receiver
comprises a transducer for converting the acoustic signal to a representative electrical
signal and an output for communicating the electrical signal.

56. (original) The system of claim 55 further comprising:

a processor configured to communicate with the output of the at least one acoustic receiver, wherein the processor is arranged to determine location of the capsule on a coordinate system based at least in part on the electrical signal of the at least one acoustic receiver.

57. (amended) The system of claim 56 wherein the ~~capsule further comprises a~~ reference signal generator arranged to generate a reference signal at a predetermined time interval from transmission of the acoustic signal and at least one external reference signal receiver,

wherein the at least one external reference receiver is arranged to receive the reference signal and communicate the reference signal to the processor,

wherein the processor is arranged to use the reference signal to determine transmission time of the acoustic signal from the capsule to the at least one acoustic receiver and to determine the location of the capsule on the coordinate system.

58. (original) The system of claim 57 wherein the reference signal generator is an RF telemetry device.

59. (original) The system of claim 56 wherein the processor comprises a tracking system arranged to determine a location of the capsule along a length of the portion of the intestinal tract.

60. (amended) The system of claim 59 61 wherein the location along the length is based on the determination of a plurality of locations of the capsule as the capsule passes through the portion of the intestinal tract.

61. (original) The system of claim 50 wherein the capsule further comprises a sensor for sensing a characteristic of the intestinal tract adjacent the location of the capsule within the portion of the intestinal tract.

62. (original) The system of claim 61 wherein the sensor comprises an electrode and wherein the characteristic comprises an electrical parameter of the intestinal tract.
63. (original) The system of claim 62 wherein the electrical parameter comprises electrical impedance of an intestinal wall.
64. (original) The system of claim 62 wherein the electrical parameter comprises an electrical potential over at least a portion of an intestinal wall.
65. (original) The system of claim 64 wherein the electrical potential comprises a pacesetter potential.
66. (original) The system of claim 64 wherein the electrical potential comprises inherent spike bursts.
67. (original) The system of claim 64 wherein the electrical potential comprises an induced pacesetter potential.
68. (original) The system of claim 64 wherein the electrical potential comprises an induced spike burst.
69. (original) The system of claim 61 wherein the sensor comprises a pressure sensor.
70. (original) The system of claim 61 wherein the sensor comprises an optical sensor.
71. (original) The system of claim 61 wherein the sensor comprises a pH sensor.
72. (original) The system of claim 61 wherein the sensor comprises a strain gauge.
73. (original) The system of claim 72 wherein the strain gauge is arranged to measure contractile force.

74. (original) The system of claim 66 wherein the sensor comprises a temperature sensing device.
75. (original) The system of claim 61 wherein the sensor comprises a chemical sensor arranged to sense the presence of a chemical.
76. (original) The system of claim 50 further comprising a sampling device for obtaining a sample from the intestinal tract.
77. (original) The system of claim 61 wherein the capsule further comprises a telemetry circuit for transmitting a signal corresponding to the characteristic sensed by the sensor.
78. (original) The system of claim 77 further comprising a telemetry receiver for receiving the telemetry signal.
79. (original) The system of claim 78 wherein the telemetry receiver is coupled to the processor and wherein the processor is arranged to identify the location of the sensed characteristic within the portion of the intestinal tract.
80. (original) The system of claim 79 wherein the processor is arranged to identify the location of the sensed characteristic along a length of the portion of the intestinal tract.
81. (original) The system of claim 50 wherein the capsule comprises a treatment device for providing treatment to the intestinal tract.
82. (original) The system of claim 81 wherein the treatment device comprises a therapeutic agent delivery device.
83. (original) The system of claim 81 wherein the treatment device comprises an electrically stimulating electrode.

84. (original) The system of claim 81 wherein the treatment device comprises a marker for identifying a location.

85. (original) The system of claim 59 further comprising a second capsule wherein the second capsule comprises: a treatment device for providing treatment to the intestinal tract.

86. (original) The system of claim 85 wherein the second capsule further comprises:
a second acoustic transducer, the second acoustic transducer being arranged to emit a second acoustic signal detectable externally of a patient's body as the second capsule passes through at least a portion of the intestinal tract.

87. (original) The system of claim 86

wherein the at least one external acoustic receiver is configured to sense the second acoustic signal transmitted by the second capsule,

wherein the at least one external acoustic receiver comprises a transducer configured to convert the second acoustic signal transmitted by the second capsule to a second representative electrical signal, and a second output configured to communicate the second representative electrical signal to the processor; and

wherein the processor is arranged to determine a location of the second capsule along the length of the portion of the intestinal tract.

88. (original) The system of claim 87 wherein the second capsule comprises a second telemetry device operatively coupled to the treatment device, and

wherein the processor is configured to control an external telemetry transmitter to transmit a control signal to the second capsule, the control signal being received by the telemetry device, wherein the control signal causes the treatment device to provide treatment to the intestinal tract at a selected location along the length of the portion of the intestinal tract.

89-94 (cancelled)

95. (original) A system for treating or diagnosing the intestinal tract comprising:
- an autonomous capsule comprising an acoustic transducer, the transducer being arranged to emit an acoustic signal detectable externally of a patient's body as the capsule passes through at least a portion of the intestinal tract; and
 - a reference signal generator arranged to generate a signal from which the time of the acoustic signal generation is determined.

96-107 (cancelled)

108. (original) A method for treating an intestinal tract of a patient comprising the steps of:
- providing a first capsule comprising :
 - an first acoustic transducer;
 - providing a second acoustic transducer acoustically coupled to the patient at a location external to the patient's body;
 - introducing the first capsule into the intestinal tract wherein the capsule moves through the intestinal tract;
 - causing an acoustic signal to be emitted between the first and second acoustic transducers as the first capsule passes through at least a portion of the intestinal tract;

- determining a time lag between emitting the acoustic signal from the one the first and second transducers and receiving the signal at the other of the first and second transducers; and
- determining a first location of the capsule at least in part from the time lag.

109. (original) The method of claim 108 wherein the step of providing a second transducer comprises:

- providing a plurality of external transducers coupled to the patient at a plurality of corresponding locations external to the patient's body.

110. (original) The method of claim 109 further comprising the steps of:

causing at least one acoustic signal to be emitted between the first acoustic transducer and the plurality of external transducers; and

determining a plurality of corresponding time lags between emitting the at least one acoustic signal between the first transducer and the plurality of external transducers, to determine a capsule location within space as the capsule moves through a portion of the intestinal tract.

111. (original) The method of claim 110 further comprising the steps of:

providing the capsule with a sensor, and sensing a condition of the intestinal tract with the sensor.

112. (original) The method of claim 111 further comprising the step of correlating the condition with a location within space.

113. (original) The method of claim 111 wherein the step of sensing a condition of the intestinal tract comprises sensing pressure.

114. (original) The method of claim 111 wherein the step of sensing a condition of the intestinal tract comprises sensing inherent electrical signals of a smooth muscle associated with the intestinal tract.

115. (original) The method of claim 111 wherein the step of sensing comprises sensing at a plurality of locations.

116. (original) The method of claim 111 further comprising the step of creating a map of sensed conditions with respect to the locations.

117. (original) The method of claim 111 further comprising the steps of:

providing signals representative of each of the time lags to a processor;

providing a telemetry circuit for communicating a signal representative of the sensed condition to a telemetry receiver external of the patient, wherein the telemetry receiver and is coupled to the processor that identifies the location along the length of the portion of the intestinal tract where the condition is sensed,

providing a signal representative of the sensed condition to the telemetry receiver.

118. (original) The method of claim 108 further comprising the step of:

determining a plurality of locations of the capsule as the capsule moves through a portion of the intestinal tract to determine the capsule's position along a length of the intestinal tract.

119. (original) The method of claim 118 further comprising the step of:

providing the capsule with a sensor, and sensing a condition of the intestinal tract with the sensor.

120. (original) The method of claim 119 further comprising the step of correlating the condition with a location along the length of the tract.

121. (original) The method of claim 120 further comprising the step of determining a location for treatment.

122. (original) The method of claim 119 wherein the step of sensing comprises sensing at a plurality of locations.

123. (original) The method of claim 121 further comprising the step of:

providing a second capsule comprising a third acoustic transducer and a treatment device coupled to a telemetry circuit;

introducing the second capsule into the intestinal tract wherein the second capsule moves through the intestinal tract;

causing a second acoustic signal to be emitted between the first and third acoustic transducers as the capsule passes through at least a portion of the intestinal tract;

identifying when the second capsule has reached the location for treatment; and sending a control signal to the telemetry circuit of the second capsule to actuate the treatment device to treat the intestinal tract at the location of treatment along the length of the portion of the intestinal tract where the condition is sensed.

124. (original) The method of claim 108 further comprising the steps of:

identifying a location for treatment along the length of the portion of the intestinal tract;

providing a second capsule comprising a third acoustic transducer and a treatment device coupled to a telemetry device;

introducing a second capsule into the intestinal tract wherein the second capsule moves through the intestinal tract;

causing a second acoustic signal to be emitted between the first and third acoustic transducers as the capsule passes through at least a portion of the intestinal tract;

determining a time lag between emitting the acoustic signal from one of the first and third transducers and receiving the signal at the other of the first and third transducers; and

determining a location of the second capsule at least in part from the time lag;

identifying when the second capsule has reached the location for treatment; and treating the intestinal tract at the location for treatment.

125. (original) The method of claim 124

wherein the telemetry circuit arranged to receive a signal from a telemetry transmitter external of the patient, and

wherein the step of treating the intestinal tract comprises the step of providing a control signal from the telemetry transmitter to the telemetry circuit to instruct the second capsule to provide treatment at the location.

126. (original) The method of claim 108:

wherein the first transducer of the first capsule comprises an acoustic transmitter and wherein the second transducer located external to the patient's body comprises an acoustic receiver, and wherein the first acoustic signal is transmitted from the first transducer to the second transducer.

127. (original) The method of claim 126 wherein the step of determining a time lag comprises:

providing the first capsule with an electromagnetic signal transmitter, transmitting an electromagnetic signal from the electromagnetic signal transmitter at a predetermined time interval with respect to emitting the first acoustic signal,

receiving the electromagnetic signal at an electromagnetic signal receiver external to the patient; and

determining the time lag based on the time between receiving the electromagnetic signal and receiving the first acoustic signal.

128-139 (cancelled)

140. (amended) A system for treating or diagnosing the intestinal tract of a patient comprising:

first capsule means for passing through the intestinal tract of a patient;

means for tracking the first capsule means, the means for tracking located external to the patient's body;

an acoustic signal means for transmitting a signal between the first capsule means as it is passing through the intestinal tract of a patient, and the means for tracking; and

a location determining means for determining the location of the first capsule on a coordinate system, wherein the location determining means comprises a time differential means for determining the transmission time of the acoustic signal means between the external means and the capsule means.

141. (cancelled)

142. (amended) The system of claim 141 140 wherein the location determining means comprises a reference means for determining the time of origin of the acoustic signal means.

143. (original) The system of claim 140 wherein the location determining means is configured to determine at least one location of the first capsule means at a location along the length of a portion of an intestinal tract.

144. (original) The system of claim 143 further comprising second capsule means for passing through the intestinal tract and means for tracking the second capsule means along the length of the portion of the intestinal tract at at least one tracked location, wherein the means for tracking the second capsule means includes means for correlating the at least one tracked location of the second capsule means with the at least one location of the first capsule means.

145. (original) A system for treating or diagnosing the intestinal tract of a patient comprising:

a capsule means for emitting a detectable acoustic signal as it passes through at least a portion of the intestinal tract; and

receiver means for receiving the acoustic signal external to the patient, the receiver means comprising at least one acoustic sensor;
processor means for determining the location of the capsule on a coordinate system based on the acoustic signal received at the receiver means; and reference means for determining the time lag between emitting the detectable acoustic signal and receiving the acoustic signal at the at least one acoustic sensor.

146-184. (cancelled).